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Experimental high-energy physicist with research interests in top quark physics, new physics coupled to the top sector, data acquisition, instrumentation, accelerator and beam physics. Skilled in software engineering and documentation, statistical data analysis, numerical methods, real-time control systems, data acquisition and instrumentation.

## PRESENT AND PAST RESEARCH ACTIVITIES

**Dec 2008 – now: CMS Collaboration at CERN and University of California, Riverside**

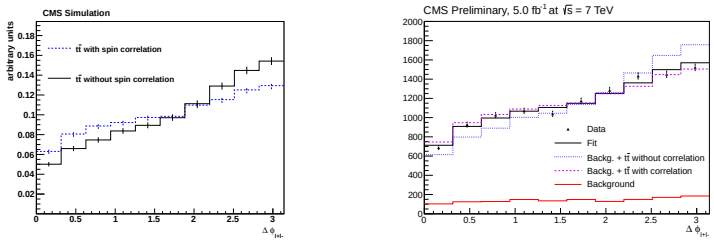
Postdoctoral Scholar. Supervisor: Prof. Robert Clare and Prof. Stephen Wimpenny.

• *Ongoing*: Endcap muon electronics upgrade.
Test, debug, and commission the on-chamber and crate electronics for chambers located in the innermost ring of the 1st layer of endcap muon stations. Develop data acquisition, monitoring, and analysis software for testing, debug, integration, and commission purposes.

(a) (b)

Figure 1: (a) Development set-up of a muon chamber with new on-chamber read-out electronics. (b) The control computer, data acquisition electronics in VME crate, and CAEN high voltage power supply.

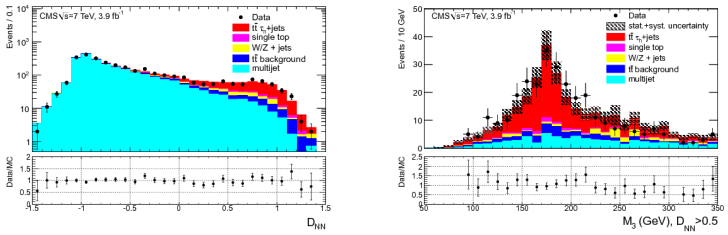
• *Ongoing*: Measurement of spin correlation and helicity fraction in $t\bar{t}$ production, CMS-PAS-TOP-12-004. CMS contribution to ICHEP 2012 (presented by me). *In preparation for publication*.
Contact person of the analysis group, co-writer of the analysis public documentation. One of the contact persons with theoretical physicists regarding specialized Fortran code to calculate cross-section with specific helicity states.




(a) (b)

Figure 2: (a) Template of $\Delta\phi$ distribution, the absolute difference of azimuthal angles of the two leptons, for $t\bar{t}$ with and without spin correlation. (b) Fit of the background-subtracted $\Delta\phi$ distribution in data to templates.

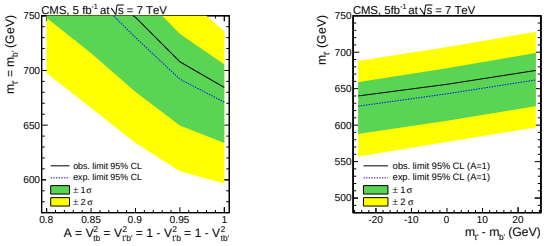
• Internal Reviewer: Measurement of $t\bar{t}$ production cross-section in the tau+jets channel in pp collisions at $\sqrt{s} = 7$ TeV, CMS-PAS-TOP-11-004. CMS contribution to Blois 2012. *Submitted to Eur. Phys. J. C*.




(a) (b)

Figure 3: (a) Distribution of the neural network output variable after a fit of the signal and multijet background processes to the data (in logarithmic scale). (b) Distribution of the reconstructed variable M3, the mass of the combination of three jets with the largest vectorially summed transverse momentum, after a fit of the signal and multijet processes to the data. An additional cut on the NN output is applied, NN $> 0.5$.

• Internal Reviewer: Inclusive search for a fourth generation of quarks with the CMS experiment, Phys. Rev. **D86**, 112003 (2012). CMS contribution to ICHEP 2012.

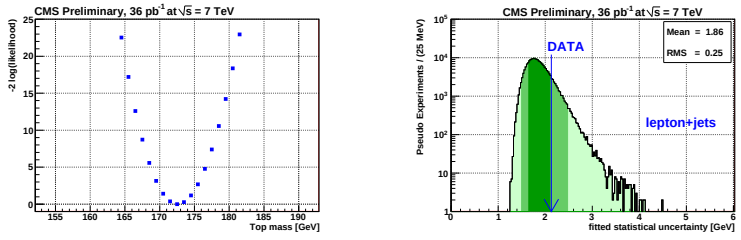



(a) (b)

Figure 4: (a) Exclusion limit in the $(A, m_{q'})$ plane, where $A = V_{tb}^2 = V_{t'b'}^2 = 1 - V_{t'b}^2 = 1 - V_{tb'}^2$ and $m_{q'}$ is the mass of degenerate fourth-generation quarks. (b) Exclusion limit of $m_{t'}$ as a function of the mass difference between $t'$ and $b'$.

• Measurement of top quark mass in the lepton+jets channel with the ideogram method, CMS-PAS-TOP-10-009, 2011. CMS contribution to PLHC 2011.
Implemented: event selection in both electron+jets and muon+jets channel, top quark mass reconstruction technique with a kinematic fitter, and top quark mass likelihood formulation and calculation. Co-editor of the analysis public documentation. Resulted in the most precise top quark mass measurement from 2010 LHC data:

$$m_{\text{top}} = 173.4 \pm 2.1\ (\text{stat})\ ^{+2.8}_{-2.5}\ (\text{syst})\ \text{GeV}.$$




(a) (b)

Figure 5: (a) Overall log-likelihood for all events selected in the lepton+jets channel, as function of the top quark mass. (b) Statistical uncertainty observed in data, compared to the distribution of statistical uncertainties in pseudo-experiments, for the combined lepton+jets channel.

• Internal Reviewer: Measurement of the $t\bar{t}$ production cross section in pp collisions at $\sqrt{7}$ TeV using the kinematic properties of events with leptons and jets, Eur. Phys. J. **C71**, 1721 (2011). CMS contribution to Moriond 2011. Presented by me at PLHC 2011.

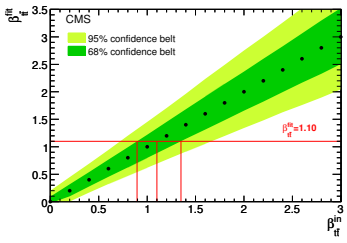
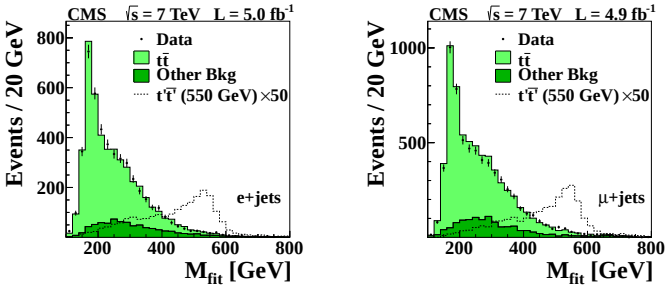



Figure 6: Neyman construction including all systematics for the measurement of $t\bar{t}$ production cross-section in the lepton+jets channel. The horizontal red line indicated the determined value of $\beta_{t\bar{t}} = 1.10$ from the binned likelihood fit to data, where $\beta_{t\bar{t}}$ is the ratio between the observed $t\bar{t}$ yield and the expected $t\bar{t}$ yield calculated using theoretical cross-section.

• HITFIT, a kinematic fitter for $t\bar{t}$ lepton+jets events. Documentation available at:
`http://haryo.web.cern.ch/haryo/doc/HitFit`
Adapted a software package that does constrained multidimensional fit (18 variables and 3 constraints) in high-energy physics into CMS programming environment. Wrote extensive documentation and provided users' support. Imported and adapted the software to run in CMS software framework. Wrote extensive documentation and provide support for users. Within CMS, HITFIT has been used as key tool in the following analyses:

- TOP-10-009 Measurement of the top quark mass in the lepton+jets channel. Most precise measurement of the top quark mass from 2010 LHC data:
$m_{\text{top}} = 173.4 \pm 2.1\ (\text{stat})\ ^{+2.8}_{-2.5}\ (\text{syst})$ GeV.
- TOP-11-015 Measurement of the top quark mass in the lepton+jets channel. Most precise measurement of the top quark mass from 2011 LHC data:
$m_{\text{top}} = 172.6 \pm 0.6\ (\text{stat} + \text{JES})\ \pm 1.2\ (\text{syst})$ GeV.
- EXO-11-099 Search for t′ pair production in the lepton+jets channel. Currently the most stringent lower bound of the t′ quark mass:
$m_{t'} \geq 580$ GeV.



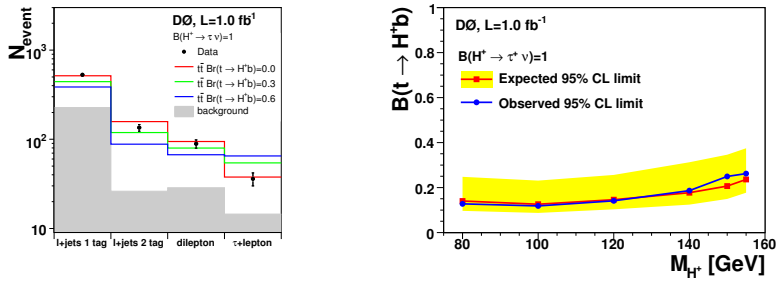

(a) (b)

Figure 7: (a) Distribution of the fitted mass in the electron+jets channel. (b) Distribution of the fitted mass in the muon+jets channel. It is clear that HITFIT can discriminate between $t\bar{t}$ and $t'\bar{t}'$ production.

**Sep 2001 – Nov 2008: D0 Collaboration at Fermilab and Florida State University**

Doctoral Student. Supervisor: Prof. Todd Adams.

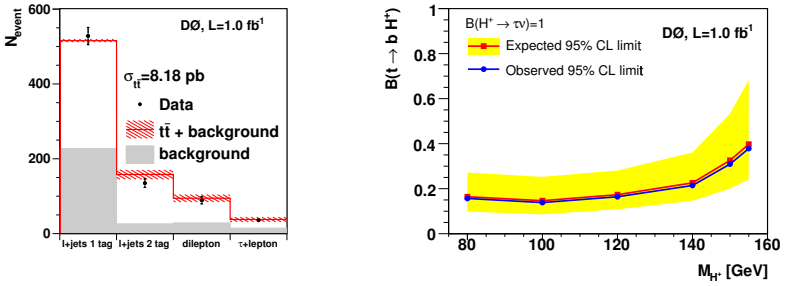
• Search for charged Higgs boson in top quark decay, Phys. Lett. **B682**, 278-286, 2009. D0 contribution to ICHEP 2008. Featured in Fermilab Results of The Week on October 28, 2008.
Contributed the tau+electron and tau+muon channel. The contribution enabled the first simultaneous fit of top quark-antiquark pair production cross-section and the branching ratio of top quark to charged Higgs boson. The simultaneous fit eliminated a major systematic uncertainty from the theoretical value of top quark-antiquark production cross-section. Resulted in the most stringent limit of the branching ratio of top quark to charged Higgs boson from Tevatron's first one inverse femtobarn, e.g.:
BR$(t \to H^+ b) \leq 0.13$ with $\sigma_{t\bar{t}} = 8.07^{+1.17}_{-1.04}$ pb for charged Higgs of mass 80 GeV.




(a) (b)

Figure 8: (a) Number of expected and observed events versus final state for $m_{H^+} = 80$ GeV assuming exclusive $H^+ \to \tau^+ \nu_\tau$. For increasing BR$(t \to H^+ b)$, the number of expected events in tau+lepton channel increases while the number of expected events in the other channels decreases. (b) Upper limit on BR$(t \to H^+ b)$ for the simultaneous fit of BR$(t \to H^+ b)$ and $\sigma_{t\bar{t}}$ versus $m_{H^+}$.

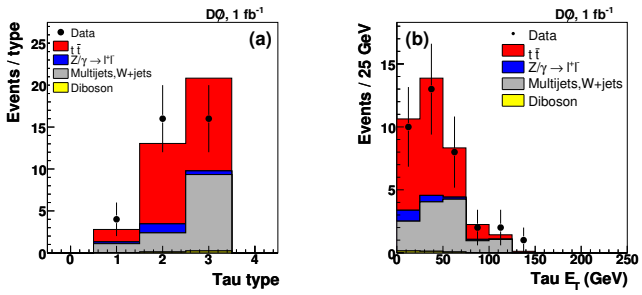
• Combination of $t\bar{t}$ cross section measurements and constraints on the mass of the top quark and its decays into charged Higgs bosons, Phys. Rev. **D80**, 071102 (Rapid Communications), 2009. D0 contribution to Moriond 2009.
Contributed the tau+electron and tau+muon analyses in the combination..




(a) (b)

Figure 9: (a) Expected and observed number of events versus channel used in measuring the combined $\sigma_{t\bar{t}}$. (b) Upper limit on BR$(t \to H^+ b)$ for tauonic $H^+$ decays.

• Measurement of $t\bar{t}$ production cross-section in the tau+lepton channel, Phys. Lett. **B679**, 177-185, 2009. D0 contribution to LeptonPhoton 2007. Presented by me at Pheno'08.
PhD dissertation work. Initiated D0 research involving tau lepton in top quark physics. Introduced tau lepton identification technique into top quark physics program in D0. First D0 results on tau+electron and tau+muon channel of top quark-antiquark pair decay:
$\sigma_{t\bar{t}} = 7.5^{+1.0}_{-1.0}\,(\text{stat})^{+0.7}_{-0.6}\,(\text{syst})^{+0.6}_{-0.5}\,(\text{lumi})$ pb.



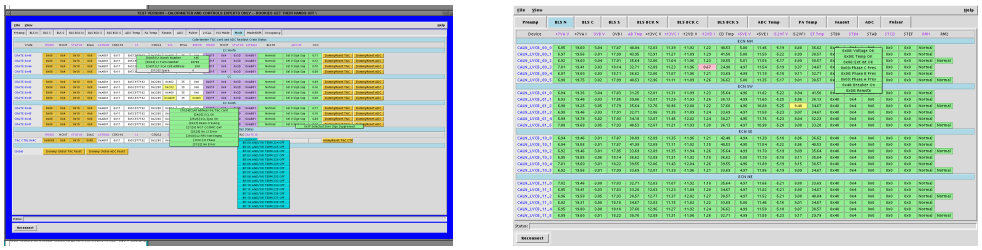

(a) (b)

Figure 10: (a) Expected and observed distributions in the $\ell\tau$ channel for (a) the $\tau$-type and (b) $E_T$ of the $\tau$ lepton. The $t\bar{t}$ contributions is normalized to the cross-section measured in the $\ell\tau$ channel.

• Implemented a method to discriminate between tau lepton and electron based on information of geometrical position. Reduced the fake rate of tau lepton from electron by a factor of more than 90 %.

• Detector control systems of the D0 Calorimeter.

- Developed control systems application for D0 Calorimeter. The application was written in Python and Tkinter, in Linux environment and EPICS control system framework. The D0 Calorimeter was built from approximately 20 different hardware types and consists of about 200 unique hardware elements. The application monitored and controlled about 3,000 real-time variables. The application's source code has approximately 15,000 lines of code.
- Created and implemented EPICS records representing the operational status of D0 Calorimeter. Utilized SQL tools to maintain the ORACLE database of EPICS records.
- Reconfigured VME memory mapping through VxWorks kernel modification. Later upgraded systems hardware from custom-built VME memory mapping adapters to multiple Motorola VME single-board computers (SBCs) as Input Output Controllers (IOCs).
- Solved long-standing problems of controlling multiple hardwares connected to single multibinary I/O register.



(a) (b)

Figure 11: Example display from the control applications for (a) Status of the calorimeter readout electronics (b) Status of the calorimeter power supplies.

**Sep 1994 – Jul 2001: University of Indonesia**

Pre-doctoral Student. Supervisor: Dr. rer. nat. Terry Mart (now Full Professor).

• Kaon photoproduction on nucleon from threshold to the multi-GeV region, MSc thesis.

Developed a phenomenological model using Regge pole approach for kaon photoproduction at high momentum transfer in the forward region. Wrote a fitting program in Fortran and MINUIT minimization algorithm library. Performed a multidimensional fits of theoretical model to more than 600 experimental data points. Extracted hadronic coupling constants and hadronic resonance masses from the fit.

• Gerasimov-Drell-Hearn (GDH) sum rule in kaon photoproduction, BSc thesis, Phys. Rev. **C60** (1999), 028201.
Wrote a Fortran program to integrate a sum rule related to total cross-section of kaon photoproduction. Estimated the contribution of strange quark sea into the anomalous magnetic moment of nucleon.

## STUDENT SUPERVISION

1. Shih-Chuan Kao, Ph.D., University of California, Riverside, 2011 (Advisor: Robert Clare and Stephen Wimpenny).

   Dissertation: *Measurement of the top quark pair production cross-section using a topological method*.

## TEACHING

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|---|---|
| *Sep 2001 – Apr 2002* | Department of Physics, The Florida State University.<br>Laboratory assistant: Undergraduate Astronomy Laboratory. |
| *Feb 1998 – Dec 2000* | Department of Physics, University of Indonesia.<br>Laboratory assistant: Undergraduate Physics Laboratory<br>Grader and recitation instructor: Undergraduate Quantum Mechanics and Graduate Quantum Mechanics. |

## SYNERGISTIC ACTIVITIES

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|---|---|
| *Mar 2012 – now* | Official Tour Guide for CMS Underground Area, CERN Globe Exhibition, CERN SM18 Superconducting Magnet Test Facility. |
| *Dec 2011 – now* | Active in building official relation between Indonesia and CERN.<br>Reference: Professor Emmanuel Tsesmelis, CERN Directorate Office. |

## GRANTS AND AWARDS

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|---|---|
| *Oct 2012* | Fermilab LHC Physics Center Guest and Visitor Program, Oct-Nov 2012, USD 1,000. |
| *Jan 2012* | Fund for attending US Particle Accelerator School, University of Texas at Austin, Texas. |
| *Sep 2011* | Fermilab LHC Physics Center Guest and Visitor Program, Sep-Oct 2011, USD 2,900. |
| *Jun 2004* | Fund for attending Theoretical Advanced Study Institute in Elementary Particle Physics (TASI2004), Colorado University at Boulder, Colorado. |
| *Feb 2000* | Award for international scientific publication from Directorate General for Higher Education of Indonesian Ministry of Education and Culture, IDR 10M (approx USD 1,300). |

## PROFESSIONAL QUALIFICATION

### Education

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|---|---|
| *Apr 2008* | Ph.D. in Physics, Florida State University. Dissertation: *First measurement of top quark pair production cross-section in muon plus hadronic tau final states* (Advisor: Prof. Todd Adams). |
| *Jul 2001* | M.Sc. in Physics, University of Indonesia. Thesis: *Kaon photoproduction in the high-energy region* (Advisor: Dr. rer. nat. Terry Mart). |

*May 1999* B.Sc. in Physics, University of Indonesia. Thesis: *Contributions of kaon-hyperon final states to the magnetic moment of the nucleon* (Advisor: Dr. rer. nat. Terry Mart).

### Schools and trainings

*Jan 2012* Course *Accelerator Physics* (graduate level, registered for credit) at US Particle Accelerator School, University of Texas, Austin.

*Feb 2009* PVSS and CERN JCOP Framework Course. CERN Technical Training, Geneva, Switzerland.

*Jun 2004* Theoretical Advanced Study Institute in Elementary Particle Physics (TASI) 2004: *Physics in* $D \geq 4$, Boulder, Colorado.

*Jun 2002* Accelerated C++: A Short Course in Practical Programming by Example. Fermilab Training, Batavia, IL.

## SKILLS

- **High Energy Physics software and libraries (10+ years experience):**
  Mathematics and physics analysis libraries, e.g: ROOT, RooFit, TMVA, CERNLIB, GSL, CLHEP.
  Accelerator physics libraries, e.g: PBO/TRANSPORT, MAD-X.
  Monte Carlo event generator, e.g.: ALPGEN, CompHEP, MadGraph.
  Monte Carlo detector and shower simulation, e.g.: EGS4, GEANT4, PGS.
- **Computing and programming (15+ years experience):**
  Programming languages: C++, Python, C, Fortran, R, Octave, MySQL, shell script, x86 assembly.
  Operating systems: Windows, Linux/Unix, and OS X.
  Programming libraries, e.g: STL, Boost, Tkinter, Qt.
  Software development tools, e.g.: make, awk, grep, sed, gdb, valgrind, code version management & documentation.
  Large-scale computing: Batch processing and grid computing.
- **Control system (5+ years experience):**
  Control systems/ SCADA framework: EPICS and PVSS control system.
  Operating systems: VxWorks (EPICS) and Windows (PVSS).
  Infrastructure: Motorola MVME single board processor as EPICS Input Output Controllers (IOCs), VME, CAN, and MIL-STD-1553 bus protocols.

## REFERENCES

**Prof. Robert Clare**
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Robert.Clare@ucr.edu

**Prof. Stephen Wimpenny**
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**Prof. Todd Adams**
*PhD advisor*
Phone +1-850-644-7159
tadams@hep.fsu.edu

**Prof. Emmanuel Tsesmelis**
*Advisor for CERN Director-General on Indonesia*
Phone +41-76-487-4057
Emmanuel.Tsesmelis@cern.ch

## SELECTED PUBLICATIONS AND PRESENTATIONS

### Refereed Publications with Significant Contributions as Author

[1] D0 Collaboration, V. Abazov *et al.*, *Search for charged Higgs bosons in top quark decays*, *Phys.Lett.* **B682** (2009) 278–286, arXiv:0908.1811.

[2] D0 Collaboration, V. Abazov *et al.*, *Combination of $t\bar{t}$ cross section measurements and constraints on the mass of the top quark and its decays into charged Higgs bosons*, *Phys.Rev.* **D80** (2009) 071102, arXiv:0903.5525.

[3] D0 Collaboration, V. Abazov *et al.*, *Measurement of the $t\bar{t}$ production cross section and top quark mass extraction using dilepton events in $p\bar{p}$ collisions*, *Phys.Lett.* **B679** (2009) 177–185, arXiv:0901.2137.

[4] D0 Collaboration, V. Abazov *et al.*, *The Upgraded D0 detector*, *Nucl.Instrum.Meth.* **A565** (2006) 463–537, physics/0507191.

[5] S. Sumowidagdo and T. Mart, *Kaon photoproduction on the nucleon: Contributions of kaon hyperon final states to the magnetic moment of the nucleon*, *Phys.Rev.* **C60** (1999) 028201, nucl-th/9906026.

Signed all CMS publications since January 2010.
Signed 176 D0 publications which were submitted between May 2005 and December 2009.

### Refereed Publications with Significant Contributions as Internal Reviewer

[1] CMS Collaboration, S. Chatrchyan *et al.*, *Measurement of the $t\bar{t}$ production cross section in the tau+jets channel in $pp$ collisions at $\sqrt{s} = 7$ TeV*, arXiv:1301.5755. Submitted to Eur. Phys. J. C.

[2] CMS Collaboration, S. Chatrchyan *et al.*, *Combined search for the quarks of a sequential fourth generation*, *Phys.Rev.* **D86** (2012) 112003, arXiv:1209.1062.

[3] CMS Collaboration, S. Chatrchyan *et al.*, *Measurement of the $t\bar{t}$ Production Cross Section in $pp$ Collisions at $\sqrt{s} = 7$ TeV using the Kinematic Properties of Events with Leptons and Jets*, *Eur. Phys. J.* **C71** (2011) 1721, arXiv:1106.0902.

### Preliminary Results with Significant Contributions as Author

[1] CMS Collaboration, "Measurement of spin correlation in $t\bar{t}$ events in the dilepton channels in pp collisions at $\sqrt{s} = 7$ TeV." CMS-PAS-TOP-12-004, 2012. `http://cdsweb.cern.ch/record/1461788`.

[2] CMS Collaboration, "Measurement of the top quark mass in the lepton+jets channel." CMS-PAS-TOP-10-009, 2011. `http://cdsweb.cern.ch/record/1356578`.

[3] D0 Collaboration, "Measurement of $t\bar{t}$ production cross section in the lepton + tau + b-jet(s) + missing transverse energy channel using 1 fb$^{-1}$ of Run II Data." D0 Conference Note 5451, 2007. `http://www-d0.fnal.gov/Run2Physics/WWW/results/prelim/TOP/T58/`.

### Publications in Conference Proceedings

[1] S. Sumowidagdo, *Top quark cross section measurements with CMS*, in *Proceedings of the Physics at the Large Hadron Collider (PLHC) 2011, Perugia, Italy*. In press.

[2] T. Mart, S. Sumowidagdo, D. Kusno, C. Bennhold, and H. Haberzettl, *Kaon photoproduction on the nucleon: Overview of some applications*, *Nucl.Phys.* **A684** (2001) 502–504, nucl-th/0008001. Prepared for the 16th International Conference on Few-Body Problems in Physics (FB 16), Taipei, Taiwan.

[3] T. Mart, S. Sumowidagdo, C. Bennhold, and H. Haberzettl, *Phenomenological aspects of kaon photoproduction on the nucleon*, in *Proceedings of the 2nd KEK-Tanashi International Symposium on Hadron and Nuclear Physics with Electromagnetic Probes*, pp. 113–118, 1999. nucl-th/0002036.

### Colloquia

1. *Top quark cross section and properties measurements with CMS*, Northwestern University, 3rd October 2011.

### Conference Presentations

1. *Spin correlations and W helicity in top events with CMS*, parallel talk presented at the XXXVI International Conference on High Energy Physics, July 4-11, 2012, Melbourne, Australia.
2. *Toplike-Beyond Standard Model Physics and Boosted Objects at CMS*, parallel talk presented at the workshop on Implications of LHC Results for TeV-scale Physics, Aug 29-Sep 2, 2011, CERN, Geneva, Switzerland.
3. *Top quark cross section measurements with CMS*, parallel talk presented at the Physics at the LHC 2011, June 6-11, 2011, Perugia, Italy. Proceeding article submitted.
4. *Measurement of top quark pair production cross-section in lepton plus hadronic tau channel*, parallel talk presented at the Phenomenology '08 Symposium, April 28-30, 2008, Madison, Wisconsin, USA.
5. *Simultaneous measurement of the ratio* $\mathrm{Br}(t \to Wb)/\mathrm{Br}(t \to Wq)$ *and the top quark pair production cross-section with the D0 detector at* $\sqrt{s} = 1.96$ *TeV*, parallel talk presented at Session J12. Top I at the 2008 April Meeting of the American Physical Society, April 12-15, 2008, St. Louis, Missouri, USA.
6. *Gerasimov-Drell-Hearn integral in kaon photoproduction*, parallel talk presented at XVIII National Physics Symposium of the Indonesian Physical Society, April 25-27, 2000, Serpong, West Java, Indonesia.